

Please amend the claims as follows:

2424. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;
allowing the heat to transfer from the one or more heaters to a part of the formation; and
producing a mixture from the formation through one or more production wells, wherein the heating is controlled such that the mixture is produced from the formation as a vapor, and wherein at least about 7 heaters are disposed in the formation for each production well.
2430. (amended) The method of claim 2424, wherein at least one of the one or more heaters comprises a natural distributed combustor.
2433. (amended) The method of claim 2424, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:
heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and
wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h * V * C_v * \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate of the formation (h) is about 10 °C/day.
2435. (amended) The method of claim 2424, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).
2447. (amended) The method of claim 2424, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-

condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere of absolute pressure.

2457. (amended) The method of claim 2424, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2458. (amended) The method of claim 2424, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5151. (amended) The method of claim 2424, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone in the part of the formation.

5152. (amended) The method of claim 2424, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5153. (amended) The method of claim 2424, wherein at least one of the one or more heaters is disposed in an open heater well.

5154. (amended) A method of treating a coal formation in situ, comprising:

- providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;

- allowing the heat to transfer from the one or more heaters to a part of the formation; and

- producing a mixture from the formation through one or more production wells, wherein at least about 7 heaters are disposed in the formation for each production well.

5156. (amended) The method of claim 5154, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone in the part of the formation.

5157. (amended) The method of claim 5154, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5158. (amended) The method of claim 5154, wherein at least one of the one or more heaters is disposed in an open heater well.

5161. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises an electrical heater.

5162. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a surface burner.

5163. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a flameless distributed combustor.

5164. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a natural distributed combustor.

5167. (amended) The method of claim 5154, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate of the formation (h) is about 10 °C/day.

5169. (amended) The method of claim 5154, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

5181. (amended) The method of claim 5154, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere of absolute pressure.

5189. (amended) The method of claim 5154, further comprising:
providing hydrogen (H_2) to the part of the formation to hydrogenate hydrocarbons within the part of the formation; and
heating a portion of the part of the formation with heat from hydrogenation.

5191. (amended) The method of claim 5154, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

5192. (amended) The method of claim 5154, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5196. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;
allowing the heat to transfer from the one or more heaters to a part of the formation; and

producing a mixture from the formation through one or more production wells, wherein the heating is controlled such that substantially all of the mixture is produced from the formation as a vapor, and wherein at least about 7 heaters are disposed in the formation for each production well.

5198. (amended) The method of claim 5196, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone in the part of the formation.

5199. (amended) The method of claim 5196, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5200. (amended) The method of claim 5196, wherein at least one of the one or more heaters is disposed in an open heater well.

5201. (amended) The method of claim 5196, wherein at least one of the one or more heaters comprises a natural distributed combustor.

5204. (amended) The method of claim 5196, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5205. (amended) The method of claim 5196, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein heating rate (h) is about 10 °C/day.

Response To Final Office Action Mailed December 2, 2002

A. Pending Claims

Claims 2424-2426, 2430-2449, 2457, 2458, 2460, 2461, and 5150-5205 are pending in the case. Claims 2424, 2430, 2433, 2435, 2447, 2457, 2458, 5151-5154, 5156-5158, 5161-5164, 5167, 5169, 5181, 5189, 5191, 5192, 5196, 5198-5201, 5204, and 5205 have been amended.

B. Information Disclosure Statements

Applicant has not received a signed Form PTO-1449 for references D9-D10. The Information Disclosure Statement including the above-mentioned reference was submitted on April 19, 2002. Applicant respectfully requests a signed Form PTO-1449 form for reference D9-D10.

C. Provisional Double Patenting Rejection

The Examiner provisionally rejected claims 2424-2426, 2430-2449, 2457, 2458, 2460, 2461, 5150-5160, 5164-5183, 5191, 5192, and 5194-5205 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims of copending U.S. Patent Application Nos.:

09/840,936; 09/840,937; 09/841,000; 09/841,060, 09/841,127; 09/841,128;
09/841,129; 09/841,130; 09/841,131; 09/841,170; 09/841,193; 09/841,194;
09/841,195; 09/841,238; 09/841,239; 09/841,240; 09/841,283; 09/841,284;
09/841,285; 09/841,286; 09/841,287; 09/841,288; 09/841,289; 09/841,290;

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09/841,297; 09/841,298; 09/841,299; 09/841,300; 09/841,301; 09/841,302;
09/841,303; 09/841,304; 09/841,305; 09/841,306; 09/841,307; 09/841,308;
09/841,309; 09/841,310; 09/841,311; 09/841,312; 09/841,429; 09/841,430;
09/841,431; 09/841,432; 09/841,433; 09/841,434; 09/841,435; 09/841,436;
09/841,437; 09/841,438; 09/841,439; 09/841,440; 09/841,441; 09/841,442;
09/841,443; 09/841,444; 09/841,445; 09/841,446; 09/841,447; 09/841,448;
09/841,449; 09/841,488; 09/841,489; 09/841,490; 09/841,491; 09/841,492;
09/841,493; 09/841,494; 09/841,495; 09/841,496; 09/841,497; 09/841,498;
09/841,499; 09/841,500; 09/841,501; 09/841,502; 09/841,632; 09/841,633;
09/841,634; 09/841,635; 09/841,636; 09/841,637; 09/841,638, and 09/841,639.

Applicant respectfully traverses the provisional double patenting rejection. Applicant respectfully submits that the omnibus nature of this rejection does not provide Applicant with sufficient detail in which to address such rejection. Applicant also respectfully submits that the rejection is also inconsistent with certain restrictions issued in the above-referenced cases. Applicant respectfully requests reconsideration.

Pursuant to discussion with the Examiner, for the convenience of the Examiner, Applicant will forward copies of allowed claims for the above-referenced cases to the Examiner's Supervisor. Applicant understands that the Examiner's Supervisor will review the allowed claims for the above-referenced cases and then reconsider the double patenting rejection in view of such allowed claims.

D. The Claims Are Not Obvious Over Tsai In View Of Van Meurs Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2424-2426, 2433-2437, 2457, 2458, 2460, 5150-5153, 5154-5163, 5167-5181, 5184-5194, 5196-5200, 5202, 5204, and 5205 under 35 U.S.C. § 103(a) as being unpatentable over Tsai et al. (U.S. Patent No. 4,299,285, hereinafter "Tsai") in view of Van Meurs et al. (U.S. Patent No. 4,866,118, hereinafter "Van Meurs"). Applicant respectfully disagrees with these rejections.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (CCPA 1974), MPEP § 2143.03.

Amended claims 2424, 5154, and 5196 describe a combination of features including: “providing heat from one or more heaters positioned in heater wells to at least a portion of the formation.” Support for amendments to the claims is found in the Specification at least on page 31, lines 14-19. The above quoted features, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Tsai discloses: “the oxidizing gas is injected into the injection hole at an appropriate rate and the fire is started in the coal bed at the injection well” (Tsai, col.2, lines 30-33). Applicant respectfully submits that Tsai does not appear to teach or suggest providing heat from one or more heaters positioned in heater wells to a part of the formation. Applicant respectfully requests removal of the obviousness rejection of claims 2424, 5154, 5196, and the claims dependent thereon.

If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Applicant submits, however, that many of the claims dependent on claims 2424, 5154, and 5196 may be separately patentable.

Claims 2425 and 5159 describe a combination of features including: “wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Claims 2426 and 5160 describe a combination of features including: “further comprising maintaining a temperature within the part within a pyrolysis temperature range of about 270 °C to

about 400 °C.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 2433, 5167, and 5205 describe a combination of features including:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate of the formation (h) is about 10 °C/day.

Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Claims 2434 and 5168 describe a combination of features including: “wherein allowing the heat to transfer comprises transferring heat substantially by conduction.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 2435 and 5169 describe a combination of features including: “wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 2457 and 5191 describe a combination of features, including “wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.” Applicant submits at least the above-quoted features of the

claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 2458, 5192, and 5204 describe a combination of features, including “wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.”

Permeabilities recorded in Table I of Tsai do not appear to be substantially uniform. Tsai states: “The initial permeability of the core was 2.0, after two days it was 27.5, after three days it was 77.2 and after four days it was 107 as reported in Table I” (Tsai, col. 7, lines 11-14). In addition, Table I of Tsai discloses a permeability of 107 md for Ex. 6 and a permeability of 148 md for Ex. 7, in which the axis of the core was perpendicular to the bedding plane. Tsai does not appear to teach or suggest at least the above-quoted features of the claims. Applicant submits at least the above-quoted features of claims 2458, 5192, and 5204, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 5151, 5156, and 5198 describe a combination of features including: “wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation to establish a pyrolysis zone in the part of the formation.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Amended claims 5153, 5165, and 5203 describe a combination of features including: “wherein at least one of the one or more heaters is disposed in an open heater well.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

E. The Claims Are Not Obvious Over Tsai and Van Meurs And Further In View Of Elkins Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claim 2431, 5158, and 5200 under 35 U.S.C. § 103(a) as being unpatentable over Tsai and Van Meurs and further in view of U.S. Patent No. 2,734,579 to Elkins (hereinafter “Elkins”). Applicant respectfully disagrees with these rejections.

Claims 2431, 5165, and 5203 describe a combination of features including: “controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

F. The Claims Are Not Obvious Over Tsai And Van Meurs And Further In View Of Salomonsson Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claim 2461 and 5195 under 35 U.S.C. § 103(a) as being unpatentable over Tsai and Van Meurs and further in view of U.S. Patent No. 2,914,309 to Salomonsson (hereinafter “Salomonsson”). Applicant respectfully disagrees with these rejections.

Claims 2461 and 5195 describe a combination of features including: “providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.” Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

G. The Claims Are Not Obvious Over Tsai And Van Meurs And Further In View of Stoddard et al. Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2448, 2449, 5182, and 5183 under 35 U.S.C. § 103(a) as being unpatentable over Tsai and Van Meurs and further in view of U.S. Patent No. 4,463,807 to Stoddard et al. (hereinafter "Stoddard"). Applicant respectfully disagrees with these rejections.

Claims 2448 and 5182 describe a combination of features including: "wherein the produced mixture comprises ammonia, and wherein greater than about 0.05% by weight of the produced mixture is ammonia." Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

Claims 2449 and 5183 describe a combination of features including, "wherein the produced mixture comprises ammonia and wherein the ammonia is used produce fertilizer." Applicant submits at least the above-quoted features of the claims, in combination with the other features of the claims, do not appear to be taught nor suggested by the cited art.

H. Conclusion

Applicant submits that all claims are in condition for allowance. Favorable consideration is respectfully requested.

It is believed that no fees are due in association with the filing of this and accompanying documents. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-06300/EBM.

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